

WFIRST-AFTA: European Interests

Mark Cropper

Mullard Space Science Laboratory
University College London



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1. WFI interests Europe-wide
2. Coronagraph interests, UK only
see Anthony Boccaletti's talk also



Europe and WFI: who...

- Following groups were canvassed, mostly based on *JWST* NIRSpec and *Euclid*
 - Germany: Bender (MPE), Rix (MPIA)
 - Spain: Castander (Barcelona)
 - France: le Fevre (LAM), Mellier (IAP)
 - Italy: Cimatti (Bologna), Scaramella (Rome)
 - UK: Sharples (Durham), Wright (UKATC), Davies (Oxford), Nichol (Portsmouth), Cropper (MSSL-UCL)
- All approached were asked if there were any others they knew who might be interested



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- All approached were asked if there were any others they knew who might be interested
- Those in blue replied with an expression of interest



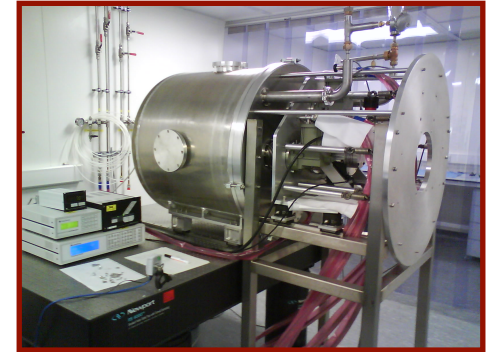
IFU: Durham interest, NIRSpec Heritage

- Collaboration with SSTL
- Durham CfAI lead in:
 - conceptual design
 - optics manufacture
 - thermal vac test (35K)
- 30 slices 3.0" x 0.1"
- WFE < 100nm
- $R_a < 5-10\text{nm}$
- For WFIRST:
 - high TRL
 - low risk

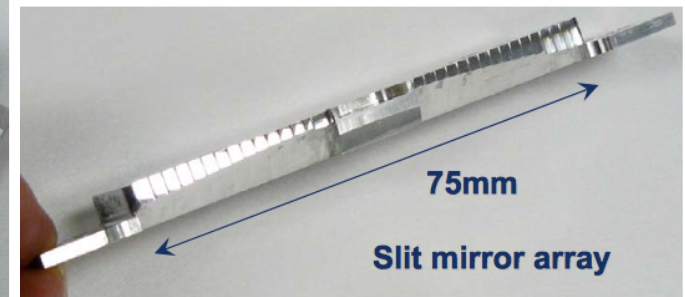
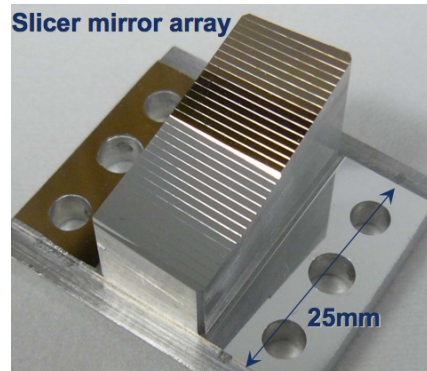
IFU engineering model structure
IFU optics mounted inside



cryo-test facility for the NIRSpec IFU



Slicer mirror array

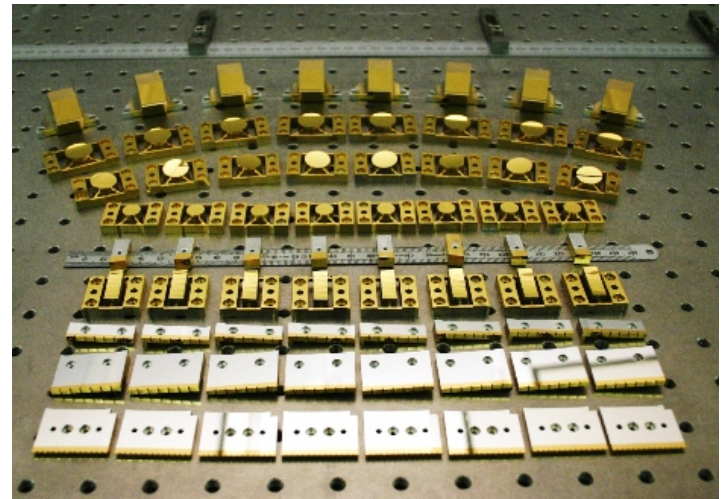


Durham Centre for Advanced Instrumentation

- Capabilities:
 - Opto-mechanical Design
 - 5-axis diamond machining & metrology
 - Thermal-vac testing
- Specific interests:
 - Integral field unit(s)



5-axis diamond machining facility



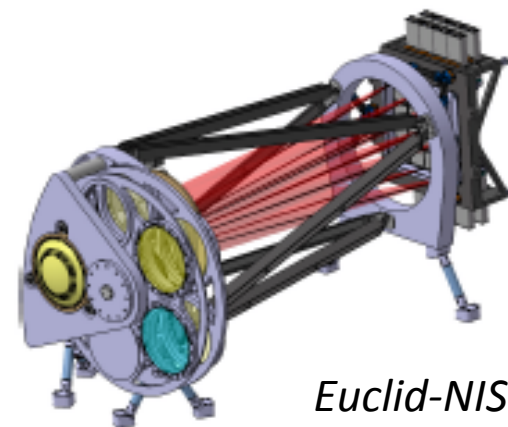
gold coated optics for 8 of the 24 VLT-KMOS IFU channels



Laboratoire d'Astrophysique de Marseille:

interests in WFIRST-WFI

- Technical interests
 - WFI design, manufacturing, tests
 - IFU spectrograph: slicer, disperser, mechanical structure
 - Opto-mechanical systems: optics, structure,...
- Science & ground segment interests
 - Expertise in deep spectroscopy survey for cosmology and galaxy evolution
 - IFU spectroscopy processing
 - Multi-wavelength analysis: photometric redshifts, SED fitting,...
 - Spectra analysis: redshifts, velocity maps, ...
- Expertise on relevant space hardware:
 - *Herschel* SPIRE FTS
 - **Lead institute *Euclid*-NISP**
- infrastructure for integration and tests in space environment
 - New 90m³ vacuum chamber (all tests for *Euclid*-NISP)



Euclid-NISP



90m³ Space testing chamber

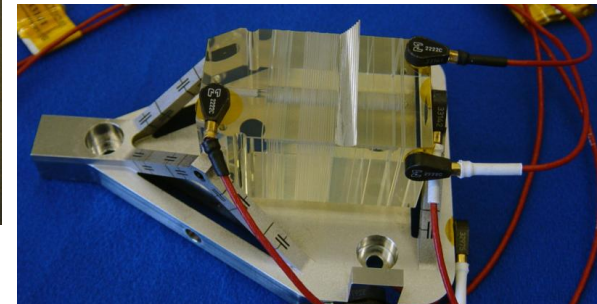
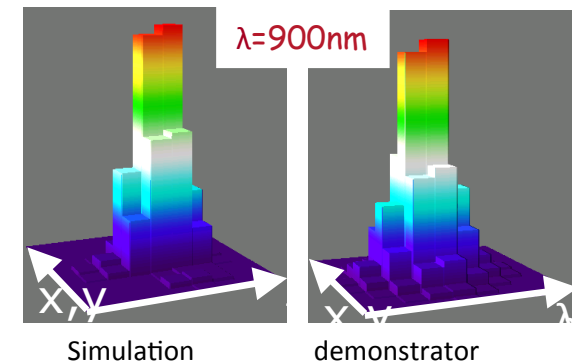
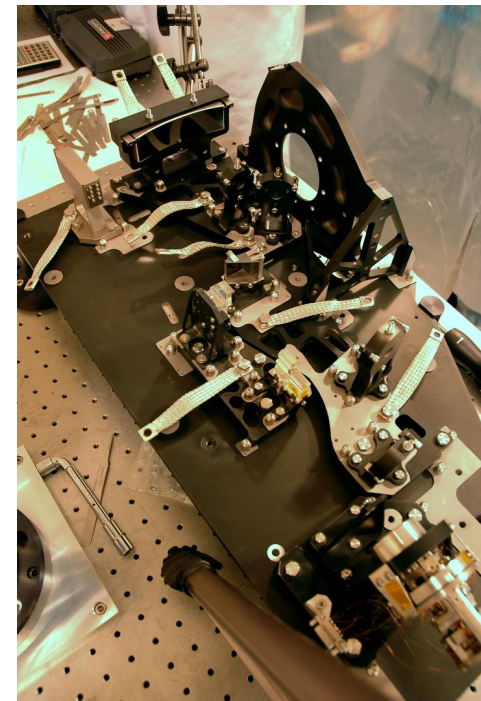
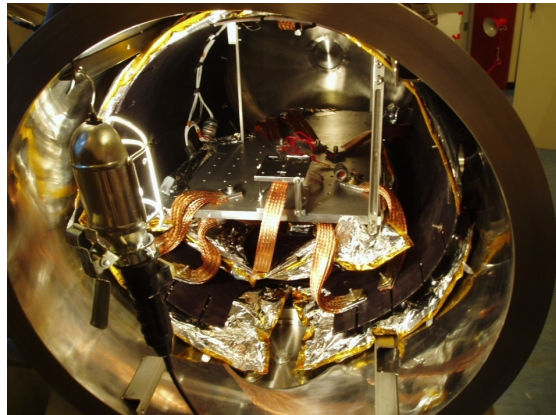


IFU spectrograph prototype

developed for SNAP study with CPPM and LBNL

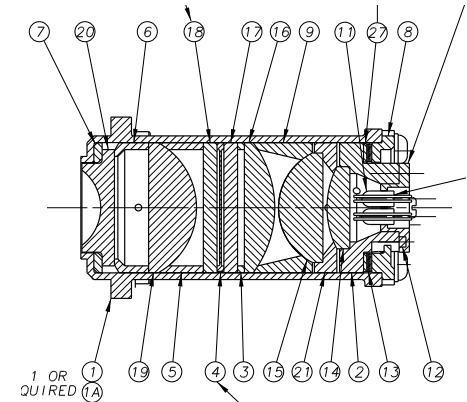
- Prototype developed and tested at LAM
 - Funded by CNES, CNRS, LBNL
 - Main space requirements (cold, vibration) satisfied
 - TRL~6 as evaluated by CNES-chaired panel, including high surface accuracy glass slicer

item	specification
FOV	4" x 4"
Pixel size	0.1"
Spect Res	~100-300
Wavelength	0.5- 1.7 μ m
Operating Temperature	140 K +/-?
Camera F/D	F/36



Calibration Unit: MSSL interest, NIRSpec Heritage

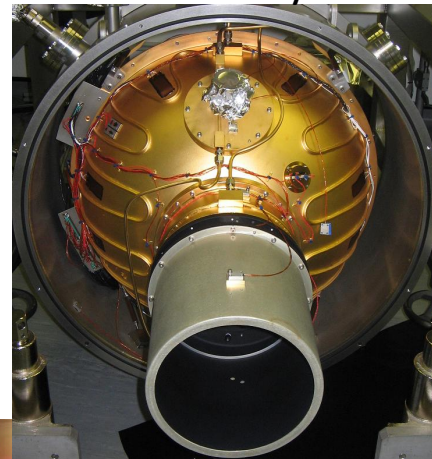
- highly specified optical and bandpass-controlled performance in 1–5 μm band
- low-dissipation light sources
- comb and broadband filters
- delivered under contract to Astrium Germany



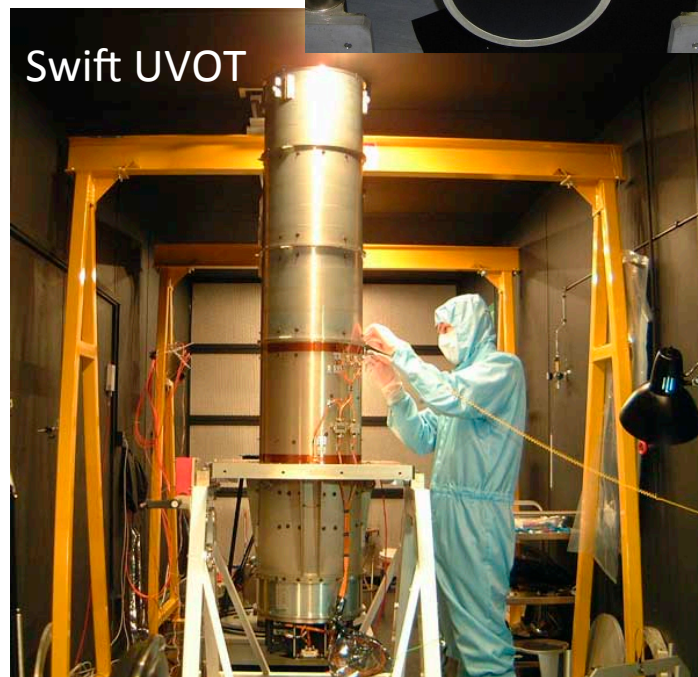
Mullard Space Science Lab, University College London

- Over 50 satellite missions with NASA, ESA, JAXA, USSR/Russia, China, India
- Recent relevant (cryogenic) missions:
 - *ISO* LWS
 - *Herschel* SPIRE
 - *JWST* NIRSpec
 - *Gaia*
 - *Euclid* (VIS instrument lead)
- Last NASA-led missions (*JWST*)
 - *Cassini* CAPS
 - *Swift* UVOT
 - *GOES*-SXI, -N, -O, -P
- Cryogenic mK ADR cryocoolers
- Science: astrophysics and cosmology

NIRSpec ground
calibration cryo-GSE



Swift UVOT



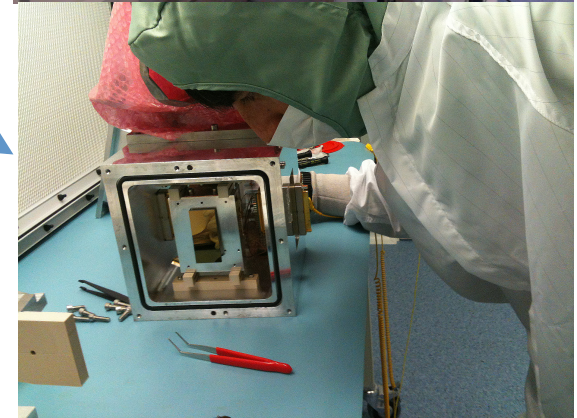
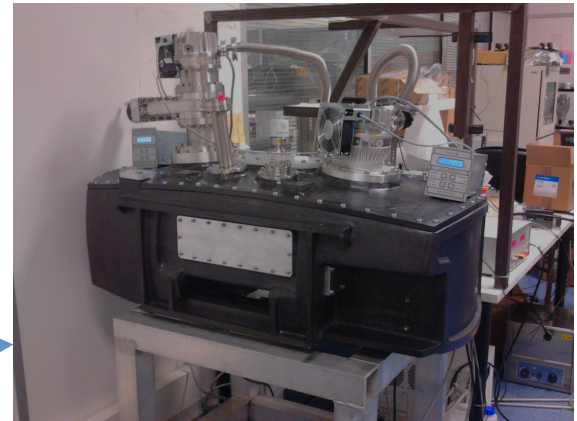
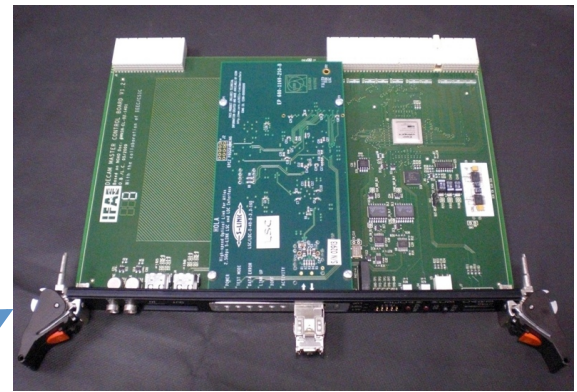
Spanish interests in WFIRST-WFI

- A consortium of Spanish institutions in Barcelona (ICE, IFAE) and Madrid (CIEMAT, IFT) are interested in a possible participation in WFIRST
- This consortium is focused on Dark Energy related research
- It is currently involved in several Dark Energy experiments: DES, PAU, DESI and Euclid
- The consortium actively participates on several aspects of these projects like management, planning, instrumental development and construction, software development and scientific coordination and exploitation
- We are interested in possible participation in the WFIRST WFI in the areas of mechanics, electronics and/or control software
- *Euclid*: leading FWA (Filter Wheel Assembly) of NISP and Simulations Organization Unit in Science Ground Segment; also, host the Spanish Data Centre



Spain: Dark Energy Experiments Instrumentation heritage

- DECam: front-end electronics and guider software
- PAUCam on WHT: overall design and construction: mechanics, electronics, software control
- also, DESI: negotiating leadership in the GFA: guiding, focus and alignment



Institute of Cosmology and Gravitation (ICG)

University of Portsmouth: interests in WFIRST

- Project and software experience
 - Significant science leadership roles in DES, SDSS, DESI and Euclid
 - Development of IFU data processing pipeline for SDSS MaNGA (IFU)
 - Founding members of “GalaxyZoo” and continued development of citizen science projects under Zooniverse
 - Joint SN light curve analysis between DES and VISTA
- WFIRST interests
 - IFU spectroscopy processing
 - SN classification and analysis, leading to improved systematics (cosmology) and astrophysics (discoveries)
 - Redshift determination from slitless spectroscopy
 - Precision Large scale structure measurements (masks, estimators, mocks)
- Expertise on relevant space missions:
 - Lead of galaxy clustering SWG in Euclid
 - BAO scientist on *Euclid* EST
 - GalaxyZoo:Hubble



UK Science Interests: WFI

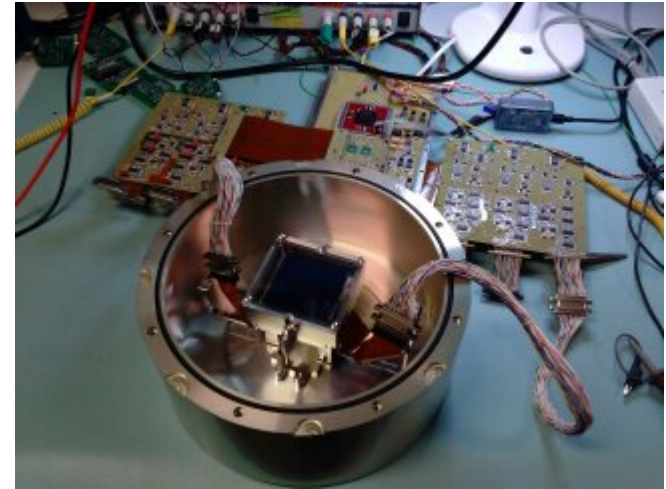
- UK has strong track record in cosmology; in particular
 - heritage in redshift surveys (2dFGS, SDSS)
 - in the weak lensing probe in *Euclid*
(Science Working Group leads, Science Ground Segment, VIS instrument lead)
 - in the galaxy clustering probe in *Euclid* (SWG lead)hence is highly interested in **scientific complementarity** offered by WFIRST-AFTA
- Supernova science is not supported by *Euclid*
⇒ significant interest from UK Supernova community who have leading roles in key on-going SN surveys
e.g. Portsmouth is leading the DES search and there is strong involvement in the PanSTARRS transient survey (Belfast, Southampton, Oxford). Expertise in SN cosmology and SN astrophysics
- **Not forgetting extensive UK galaxy evolution interests**
- In practice: involvement in WFIRST-AFTA science working groups would be welcomed
- Science links to ground segment software development



UK Interests in Coronagraph

- UK technology interest centred on
 - e2v detector capability allied with research capability at Open Univ CEI
 - MSSL-UCL camera capability (*Eddington*, *Gaia*, *Euclid*, *PLATO*)
- Highly integrated approach to system design, high performance, radiation mitigation
- Experience with operation of and space qualification of L3CCDs via *Gaia* RVS programme (MSSL-UCL and CEI-OU partnership)
- Current WFIRST contract with CEI-OU on L3CCD development
- Science interests based on *PLATO* involvement at MSSL-UCL, Warwick, Cambridge, Open University

Euclid 12-channel camera electronics



100 L3CCD97 provided by e2v for *Gaia*-RVS detector qualification



Summary

- Significant interest in WFI across Europe in both instrumentation and science
 - strong Euclid complementarity
 - track record particularly with *JWST* instruments
 - involvement in science working groups
- UK interests in Coronagraph
 - science complementarity to PLATO
 - track record in CCDs and large space CCD cameras

